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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (EEE) (Sem.-8)

**NON-LINEAR AND DIGITAL CONTROL SYSTEM**

Subject Code : EE-404

M.Code : 57056

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A****1. Write briefly :**

- a) Discuss the advantages of state space approach over transfer function approach.
- b) Explain the term Observability.
- c) Write down the condition for a system to be Controllable.
- d) Discuss any two properties of nonlinear systems.
- e) What are limit cycles?
- f) Draw the characteristics of an ideal and an actual relay.
- g) Explain dead zone with a suitable example.
- h) What do you mean by a positive definite function?
- i) How can you convert an analog signal into a digital signal?
- j) What are the limitations of Z transform?

**SECTION-B**

2. Draw the state diagram and obtain the state equation for the following transfer function :

$$G(s) = \frac{4(s+2)}{s(s+3)(s+4)}$$

3. Draw the phase portrait of the following system :

$$\ddot{\theta} + \dot{\theta} + 0.5\theta = 0$$

4. Find out the describing function for deadzone nonlinearity.

5. An autonomous system is expressed as follows :

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -m_1 x_2 - m_2 x_1$$

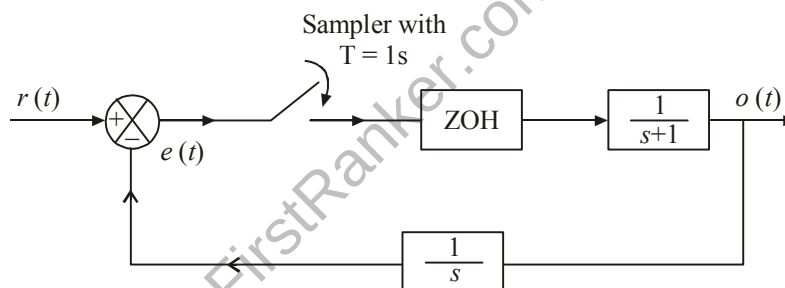
Study the stability of the system using Lyapunov's method and considering the Lyapunov's function as :

$$W = x_1^2 + x_2^2$$

6. Write a short note on Jury's stability test.

### SECTION-C

7. A closed loop control system is shown below :



**Fig.1**

Determine the output in discrete form when a unit step is applied to the input.

8. a) How can you find out Lyapunov's function by with Variable gradient method?  
b) Write a short note on discrete form of PID controller.
9. Write short notes on :  
a) Sampled data systems  
b) Phase plane analysis

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**